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Wells-Gardner Color X-Y Monitor
(Atari Part No. 92-053)

Service Manual

Complete with Schematic and Illustrated Parts Lists

ATARI®

A Warner Communications Company

Wells-Gardner Color X-Y Monitor

Service Manual

Complete with Schematic and Illustrated Parts Lists

Monitor manufactured by Wells-Gardner Electronics Corp.

Chicago, IL 60639 U.S.A.

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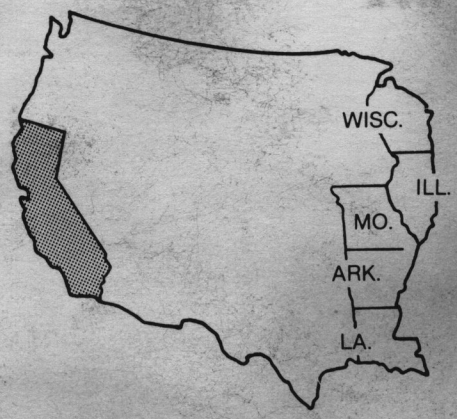

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1 Warnings and Cautions

This color X-Y monitor was designed to Atari specifications and built by Wells-Gardner Electronics Corp. The AC power, color, and X, Y, Z signals are fed to the monitor through a 15-pin harness connector located next to the right side panel.

This monitor differs very little from that used in Atari's black-and-white X-Y video games, such as Asteroids™, Battlezone™ or Red Baron. The only major difference is that it now has three Z amplifiers to control the three color guns. The cathode-ray tube is an off-the-shelf 100° in-line picture tube that is also used in raster-scan monitors.

A. Before You Start

You should **never attempt** to work on a monitor chassis if you are not familiar with servicing procedures and precautions necessary for high-voltage equipment. Any television or monitor has three sources of possible danger:

- Strong electric shock due to high voltage or unisolated AC line voltages
- X-ray radiation, and
- implosion.

Therefore, please read this chapter carefully.

You should **never attempt** to modify any circuit in this monitor. You should do service work only after you are thoroughly familiar with all of the warnings and safety measures printed in this chapter.

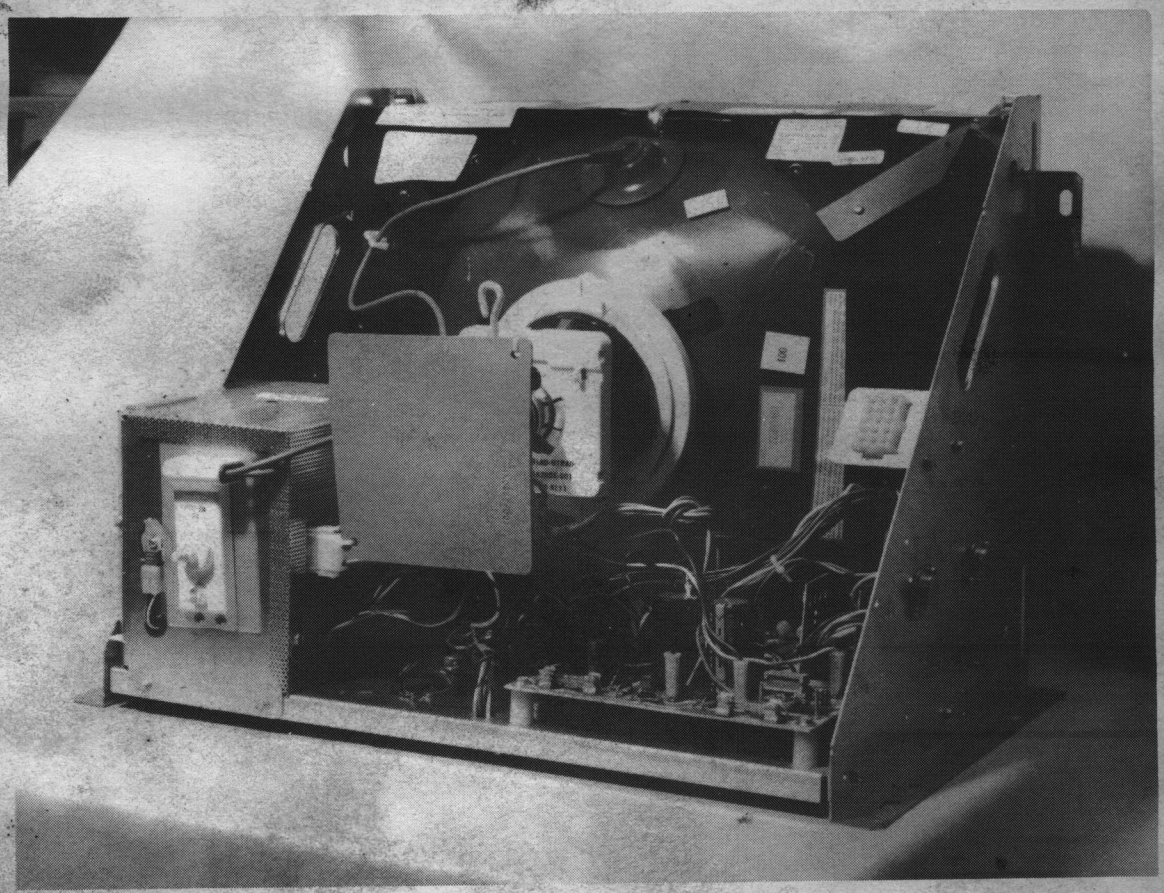


Figure 1 Overview of Monitor

WARNINGS

High Voltage

This monitor contains high voltages capable of delivering lethal quantities of energy. To avoid danger, do not attempt to service the chassis until you have observed all precautions necessary for working on high-voltage equipment.

X-Radiation

This chassis has been designed for minimum X-radiation hazard. However, to avoid possible exposure to soft X-radiation, it is imperative that you **never** modify the high-voltage circuitry.

Implosion Hazard

If you drop the monitor and the picture tube breaks, **it will implode!** Shattered glass and the yoke can fly 6 feet or more from the implosion. Use care when replacing any monitor.

B. Safety Measures

Develop good safety habits, so when you're rushed with repair work, you'll still automatically take precautions.

A good practice when working on any monitor is to first ground the chassis and **use only one hand** when testing circuitry. This will avoid the possibility of carelessly putting one hand on the chassis or ground, and the other on an electrical connection. **Doing so could cause a severe electrical shock.**

If you service this color X-Y monitor on a test bench, **use only** the power supply that came with the Tempest™ game. (It is called the *Power Supply Assembly for Color X-Y Games,* Atari part no. A037396-xx). You **CANNOT** use standard line voltage or a power supply from a black-and-white X-Y game such as Asteroids™, since the voltages produced by those sources will damage the Wells-Gardner color X-Y monitor.

To prevent fire or shock hazard, **never expose this monitor to rain or moisture.** Also check periodically for frayed insulation on wires.

If you need to service the monitor, observe the original lead dress (routing and length of harness wires). Use extra precaution in the high-voltage circuitry area of the monitor. Whenever a short circuit occurs, replace those components that indicate they have overheated.

C. Picture-Tube Handling

Use extreme care when handling the picture tube, since rough handling may cause it to implode, due to a vacuum inside. Do not nick or scratch the glass, or subject it to any undue pressure when removing or installing it.

Wear safety goggles and heavy gloves for protection when handling the picture tube. Keep others without safety goggles away. Never lift the tube by its neck.

Discharge the high voltage in the picture tube by shorting the anode connection to chassis ground—**not the cabinet or other mounting parts.** When discharging, go from ground to anode, and use a well-insulated piece of wire.

D. Replacing with Proper Components

It is important for you to maintain the specified values of all components in the high-voltage circuits, and anywhere else in the monitor that could cause a rise in high voltage, or in operating supply voltages.

Refer to the parts lists in the back of this manual (Chapter 7), and use **only exact replacement parts,** especially for the picture tube, semiconductors, transformers, coils, and fuses.

E. Final Testing Before Reinstalling Monitor

Before installing the color monitor back in the game, you must check the following:

1. Inspect all harness wiring on the monitor, and be sure none of it is pinched between the chassis and other metal parts in the monitor.
2. Replace all protective devices such as insulating fishpaper, compartment covers, and shields.

2 Specifications

A. Inputs

1. Input Voltage

25-0-25 VAC RMS center-tapped at nominal line for amplifier.

2. Input Voltage Range

+10% to −15%

3. Input Power at 60 VAC

150 watts AC (amplifiers at maximum deflection).

4. Signal Inputs (at Maximum Deflection)

"X" horizontal: 16 volts P/P (±8 volts).
"Y" vertical: 12 volts P/P (±6 volts).
"Z" beam drive: 4.0 volts maximum brightness, 1.0 volt black level.

5. Input Impedance

"X" and "Y" = 2K ohms, "Z" = 1K ohms

B. Writing Rate

"X" amplifier = .05 inch per microsecond, "Y" amplifier = .0375 inch per microsecond.

C. Z Bandwidth

5 MHz at −3 dB point.

D. High Voltage

19.5 KV at $I_b = 0$; adjustable to ±2½%. High-voltage regulation restricted to 2% maximum (I_b0 to 100 microamps.).

E. Controls

Factory-adjusted controls: high-voltage adjustment and Z tracking. Operator-adjustable controls: focus and brightness.

F. Operating Temperature and Humidity

Ambient (in the game cabinet) humidity: 0 to 90% non-condensing.
Ambient temperature: 0 to 55° C. (32 to 131° F.).

3 Adjustable Controls

Remember to observe the precautions regarding high voltages when you make adjustments on this monitor!

To make the following adjustments, keep the game in the attract or play mode. Note that before you adjust the brightness, the monitor should be turned on for at least 5 minutes.

Refer to Figure 2 for brightness (labeled *Screen*) and focus control locations.

A. Brightness

Exercise caution when adjusting the brightness control. Adjusting the brightness too high will not only cause retrace lines to become visible, but may also cause phosphor burn. Too low a brightness causes some of the objects displayed to become dark and obscured.

To set the brightness level, turn the brightness control until a center spot appears on the CRT. Then decrease the brightness until this spot disappears.

B. Focus

This control changes the sharpness of the screen image. Turn this control until you get the optimum screen sharpness possible.

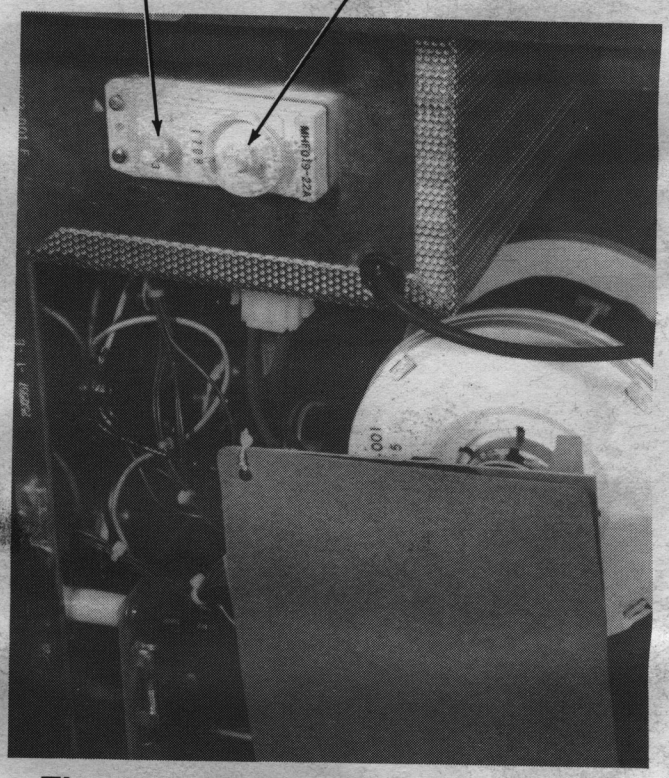


Figure 2 Adjustable Controls on High-Voltage "Cage"

4 Replacement of Major Assemblies

Tools Required to Replace all Assemblies Covered in This Chapter: 7/16-inch and 1/4-inch hex socket wrenches, and a Phillips-head torque wrench.

A. Picture-Tube Replacement

Be sure to first unplug the 15-pin power and color-signal connector. Remove monitor assembly from game as described in Chapter 2 of the game manual.

1. Discharge the high voltage from the tube. Remove the large high-voltage connector (anode wire) near the top of the picture tube. Unplug the neck board at rear of picture tube.
2. Unplug the 5-pin connector on the Deflection PCB.
3. Using a 7/16-inch hex socket wrench, remove the four screws that hold the picture tube in the steel frame. Carefully remove the tube by pulling it out toward the front.

4. **Important:** Note that after replacing a picture tube you will have to re-converge the picture and readjust the grey-level tracking. These adjustment procedures are covered in Chapter 5 of this manual.

B. Yoke Replacement

First unplug the 15-pin power and color-signal connector. Remove the monitor assembly from the game.

1. Discharge the high voltage from the tube. Unplug the neck board at rear of picture tube.
2. With a ¼-inch hex socket wrench and your fingers, loosen the screws that tighten the two neck clamps around the picture-tube neck.
3. Now slide the magnet assembly, then the yoke assembly off the end of the picture tube.
4. **Important:** Note that after replacing a yoke, you will have to re-converge the picture. This adjustment procedure is covered in Chapter 5 of this manual.

C. High-Voltage PCB Replacement

First unplug the power and color-signal connector. Remove the monitor assembly from the game.

1. Discharge the high voltage from the tube. Remove the large connector at top of picture tube. Then disengage the anode wire from its white holder on the purity shield.
2. Unplug the neck board at rear of picture tube.
3. Unplug the white, 3-pin harness connector on the side of the high-voltage cage. Also unplug the red, 8-pin harness connector just below the 3-pin connector.
4. Using a ¼-inch hex socket wrench, remove the 5 screws holding down the high-voltage protection cage. Do not remove the screws that hold together the side and bottom panels of the monitor chassis.
5. To remove the PCB from the cage, turn the cage upside down. Remove the two sheet-metal screws inside that secure the PCB. Slide the PCB at an angle out of its slots in the cage.
6. When replacing the high-voltage transformer, be sure to check the picture for correct sharpness and brightness. If it's not correct, adjust the *FOCUS* or *SCREEN* knobs on the rear of the monitor. Note that after replacing the high-voltage PCB, you will have to readjust the high voltage control. This adjustment procedure is covered in Chapter 6 of this manual (you will need a voltmeter).

D. Power Transistor Replacement

When replacing any of the power transistors, observe the following precautions:

1. Hold the insulated transistor socket in its proper location. It is not "captive" or mounted onto the metal chassis; instead, the transistor's mounting screws secure the socket.
2. Apply silicone grease evenly to both sides of the mica insulator when replacing an output transistor.
3. Make sure the transistor mounting screws are tight before applying power to the monitor. This insures proper cooling and electrical connections. Use a Phillips torque wrench and torque the mounting screws 7 to 10 inch-lbs.—**no more.** Excessive pressure will strip the threads, causing a poor electrical and mechanical connection.

E. Deflection PCB

This board is secured by mounting screws and a retaining bracket. Three plastic spacers ("standoffs") and four plastic mounting posts underneath the board keep it away from and shorting out with the metal chassis.

Use a ¼-inch hex socket wrench to remove the two rear screws. Then slide the board out towards the rear of the chassis. The harness has sufficient slack so you can service the board when it is removed from its mounting position. All plugs are keyed, so improper connection would be difficult—if not impossible.

5 Purity, Convergence and Tracking Adjustments

Remember to observe the precautions regarding high voltages when you make any adjustments on this monitor.

All the adjustments to be made in this chapter can be done while the monitor is mounted within the game. Allow at least 15 minutes for the monitor to warm-up completely before attempting the adjustments.

A. Purity Adjustments

Enter the self-test mode and advance the screens until the horizontal and vertical crosshatch pattern appears. Then, rotate the encoder wheel on the control panel until only the green pattern appears. (Refer to the Tempest manual TM-190 Figure 6, Part 2 for more information.) Check the red, green and blue testpoints on the main PCB with an oscilliscope or voltmeter to make sure that only the green signal is being sent to the monitor.

Loosen the yoke-retaining clamp so that the yoke can move. Slide the yoke toward the back. Remove any glue that may be holding the purity ring magnets in place, and rotate one or both purity rings in a line so that they face opposite directions from each other.

Slowly slide the yoke toward the front of the CRT until the pattern displayed is an overall pure green. Tighten the yoke retaining clamp lightly, making any slight physical adjustments to the yoke to maintain a pure green pattern. Rotate the yoke to level the pattern on the face of the CRT.

Turn the encoder wheel to the red and blue patterns and slightly readjust the yoke for a uniform and pure pattern for each color. Tighten the yoke-retaining clamp to prevent yoke shift or rotation.

To make fine adjustments to the purity, turn the purity magnets for the best overall purity of each color. Reglue the purity magnets with a small amount of glue.

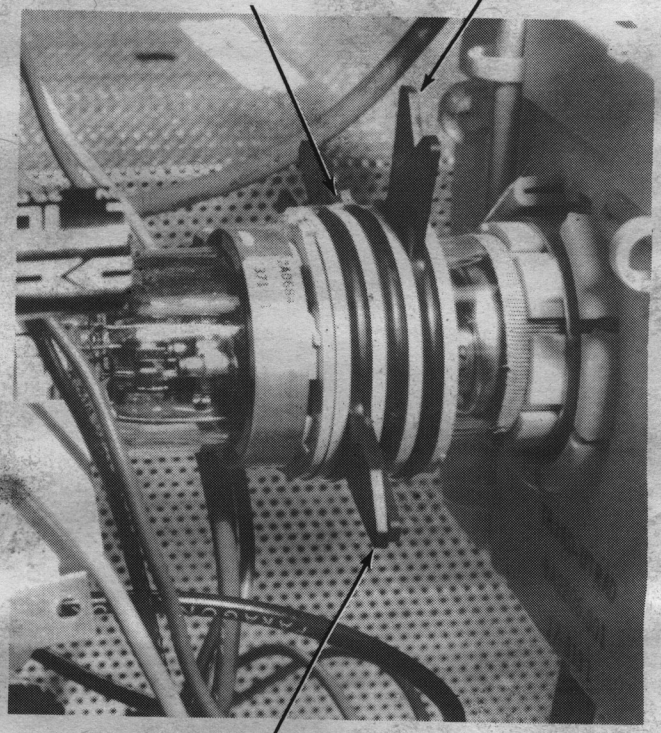


Figure 3 Adjustable Magnets on Monitor Neck

B. Static Convergence Adjustments (Center Area)

Put the game into the self-test mode and advance the screen through the patterns until the horizontal and vertical checkerboard pattern is displayed.

Turn the encoder wheel until only the red and blue lines are displayed. Adjust the tabs on the center pair of adjusting magnets so that the red and blue lines are superimposed on each other. (Do this at the center of the screen.)

Turn the encoder wheel until red, green and blue lines are displayed. Adjust the tabs on the pair of magnetic rings closest to the Neck board, so that the green line is superimposed on the red and blue lines. (Do this at the center of the screen.)

C. Tracking Adjustments (on Neck Board)

1. Preliminary

Go into self-test mode and display screen #8 (seven groups of colored bars of various intensities.)

Next, turn all potentiometers on the neck PCB to the full clockwise position. Turn the brightness control to a level that clearly displays the fifth line from the right of the center group of lines. If the sixth line from the right is visible, reduce the brightness. If the fifth line from the right is not clearly visible, increase the brightness.

2. Bias Adjustments

Adjust the red, green, and blue bias potentiometers until the fifth line from the right is pure white. R BIAS, G BIAS and B BIAS; see Figure 4.

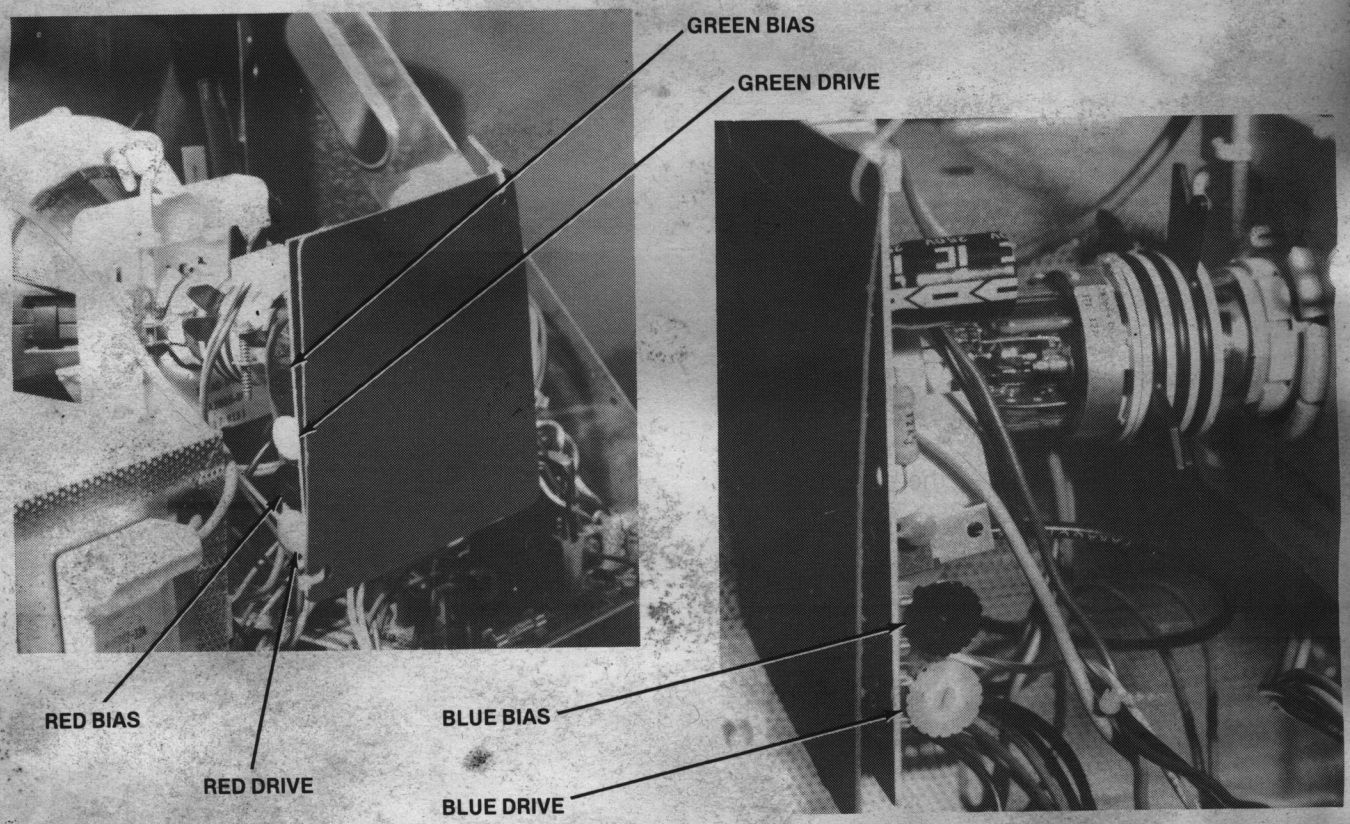


Figure 4 Adjustable Controls on Neck PCB

3. Drive Adjustments

Adjust the red, green and blue drive potentiometers until the first line on the right is pure white. Drive potentiometers are marked as follows on the neck board: R DRIVE, G DRIVE and B DRIVE; see Figure 4. Repeat step 2 if the fifth line from the right is no longer pure white.

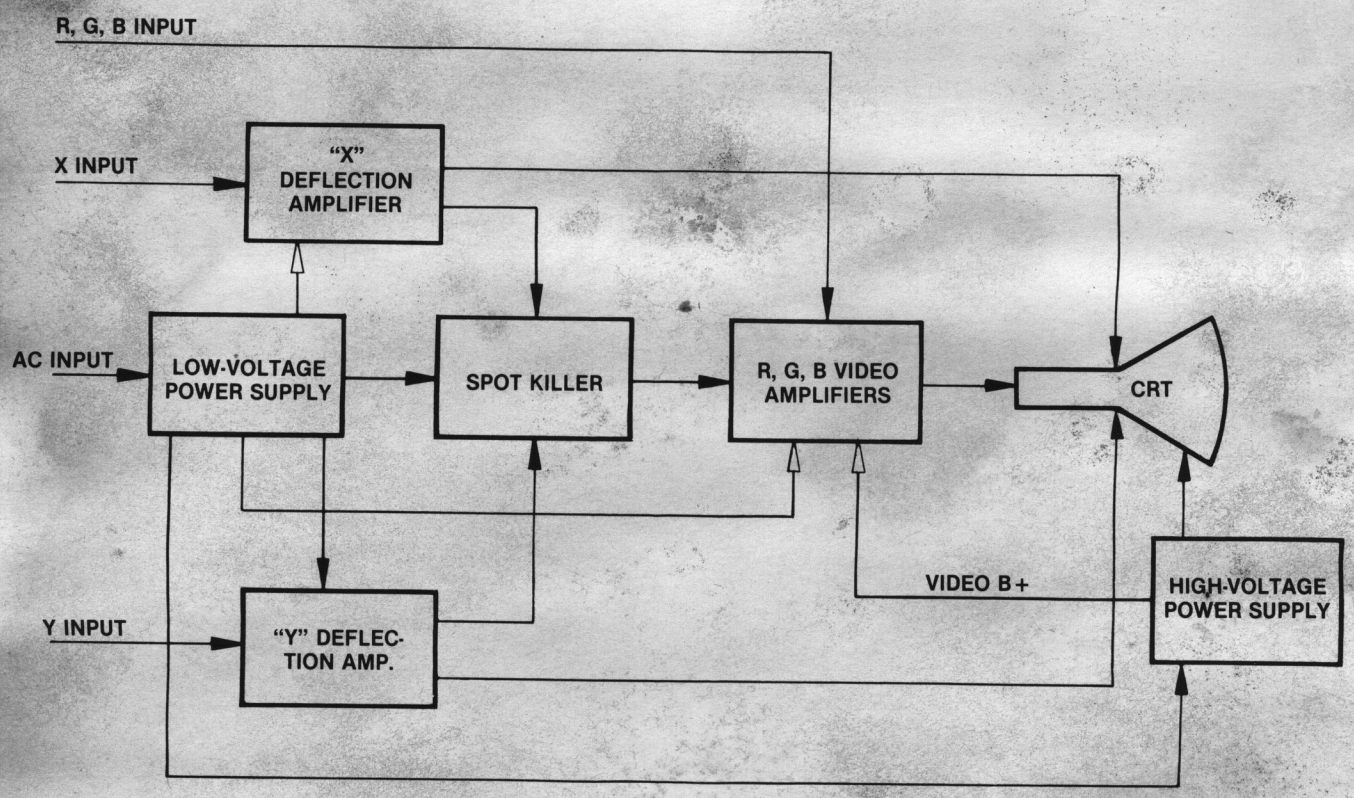


Figure 5 Monitor Block Diagram

6 Details of Operation

A. Low Voltage Power Supply

The input voltage of 48 VAC from the game power supply enters through fuses F100 and F101. Diodes D100 through D104 form a rectifier bridge that converts the AC input into an unfiltered DC. Capacitors C100 and C101 form the first stage of filtering. Resistors R102 and R103 and capacitors C102 and C103 form two low pass filters which help filter out AC ripple. Transistors Q100 through Q103 form an active filter that provides the stable, filtered DC voltages.

The degaussing coil operates when power is first applied to the monitor, when the P.T.C. (Positive Temperature Coefficient thermistor) is cool. Diodes D106 and D107 form a protective barrier from any residual current that might enter the degaussing coil during normal game play.

The output voltages from the low voltage power supply should be as follows:

J101 pin 2—ground
J101 pin 3— + 25 volts
J101 pin 4— – 25 volts

The picture tube filament voltage is taken from the front end of the low voltage power supply through D108 and R107.

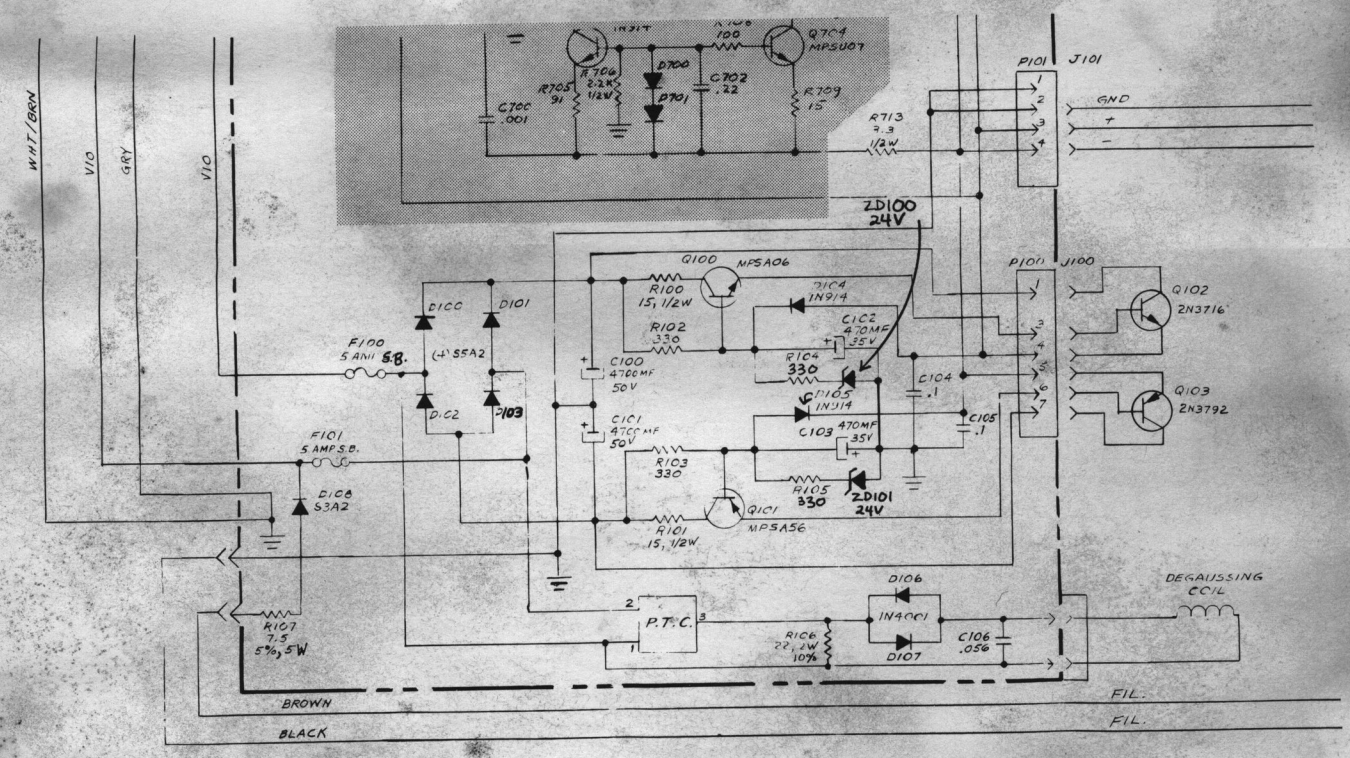


Figure 6 Schematic Diagram of Low-Voltage Power Supply

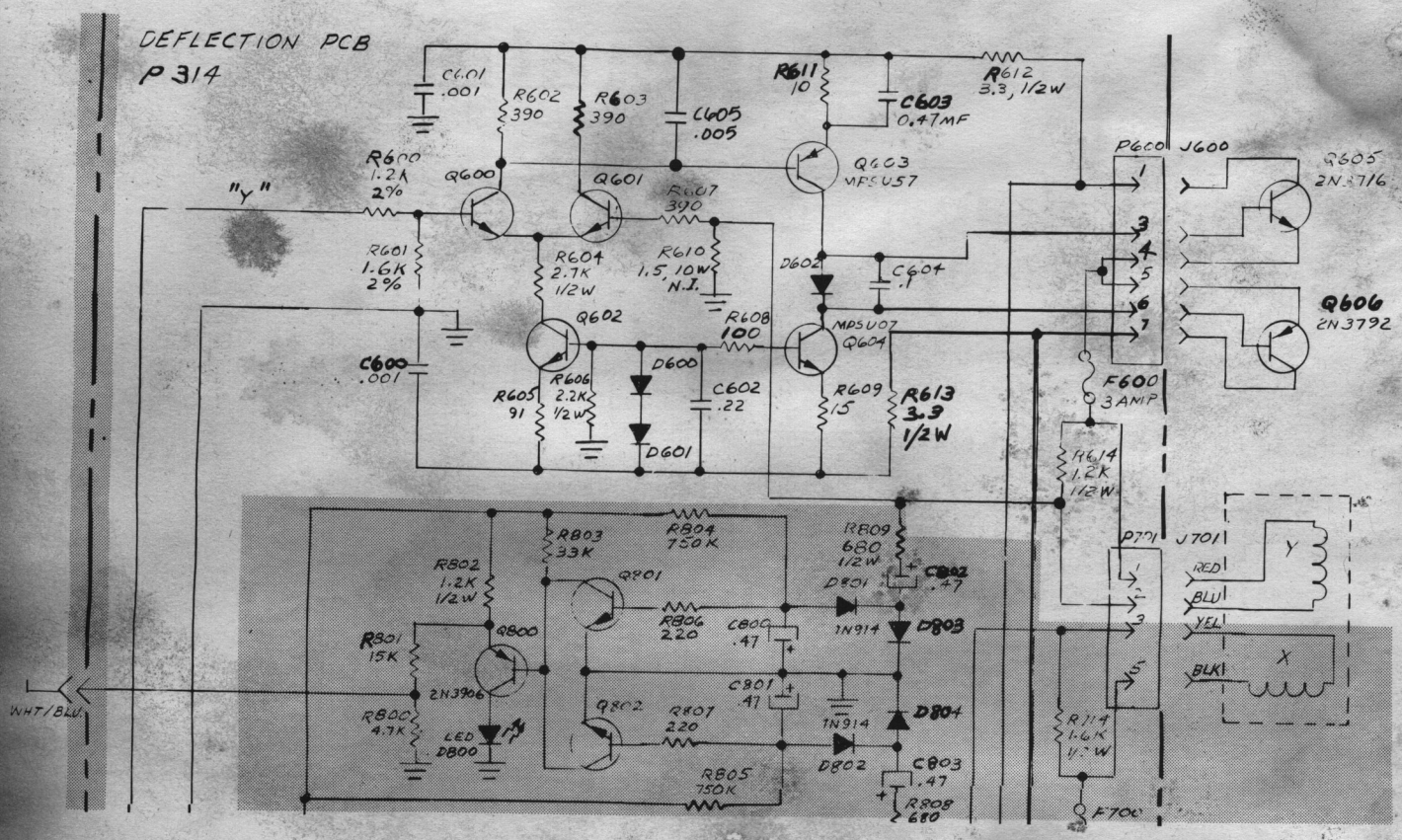


Figure 7 Schematic Diagram of Y Amplifier

B. X and Y Amplifiers

Both the X and Y amplifiers are nearly identical. For this reason only the Y amplifier is described.

The Y deflection signal from the game board is applied to the base circuit of transistor Q600. Transistors Q600 and Q601 form a differential amplifier. Transistor Q602 is a constant current source providing current to the differential amplifier. Transistor Q603 is the driver transistor that provides current to the emitter-follower transistors Q605 and Q606. Transistor Q604 is a constant current source that provides current to the driver transistor Q603. Fuse F600 can open in case of circuit failure, protecting the deflection coil in the yoke from damage.

C. Z Amplifiers (Red, Green, and Blue)

Since the red, green and blue amplifiers are identical, only the blue amplifier will be described.

Transistor Q502 is a common emitter amplifier used to provide gain for the blue intensity signal. Resistor R509 is the blue drive pot which determines the amount of gain in the blue amplifier. Resistor R513 is the blue bias pot which determines the cutoff characteristics of the blue amplifier. The output of the Z amplifiers bias the cathodes of the three electron guns within the picture tube.

Transistor Q503 is biased by a voltage from the spot killer. When transistor Q503 is cutoff, then zener diode ZD500 allows the emitter of transistor to rise in voltage. This allows the emitter of transistor Q502 to rise in voltage, which disables the blue signal from the picture tube.

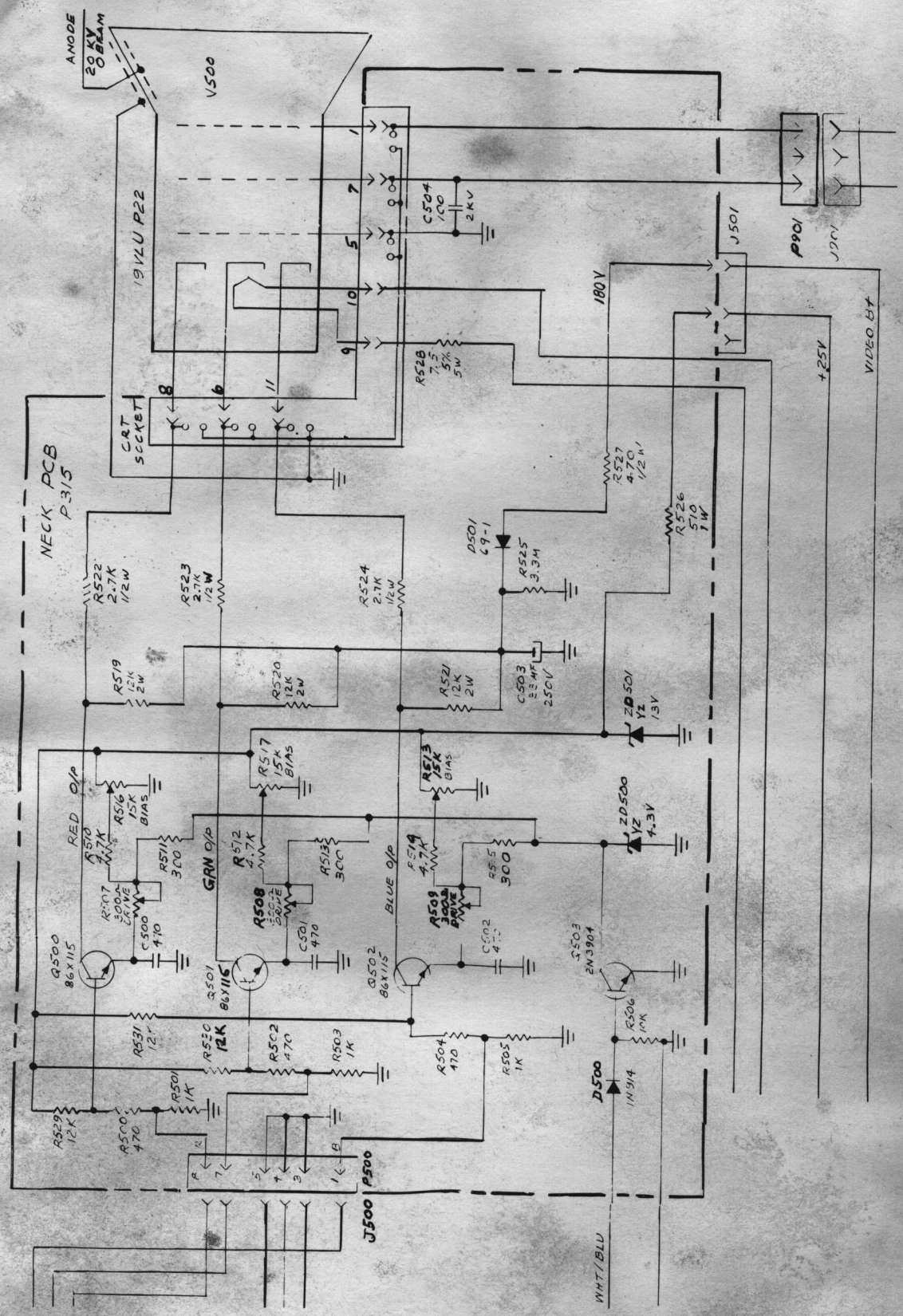


Figure 8 Schematic Diagram of Blue Amplifier

D. Spot Killer Circuitry

The purpose of the spot killer is to turn off the video intensity amplifiers when deflection is not occurring. Failure of the spot killer can cause the phosphor coating on the picture tube to become burned.

The two signal input voltages to the spot killer are taken from resistors R610 and R710 in the X and Y deflection circuits. Diodes D801 through D804 and capacitors C800 through C803 form two separate voltage doublers. The outputs of the voltage doublers are applied to the bases of transistors Q801 and Q802. When either of the deflection amplifiers is not driving current through the deflection coils, then either transistor Q801 or Q802 becomes biased so that it conducts, which turns on transistor Q800 and the LED D800 in its collector circuit. When transistor Q800 is conducting, then transistor Q503 in the Neck Board is cut off, forcing the RED, GREEN and BLUE amplifiers to turn off their electron beams.

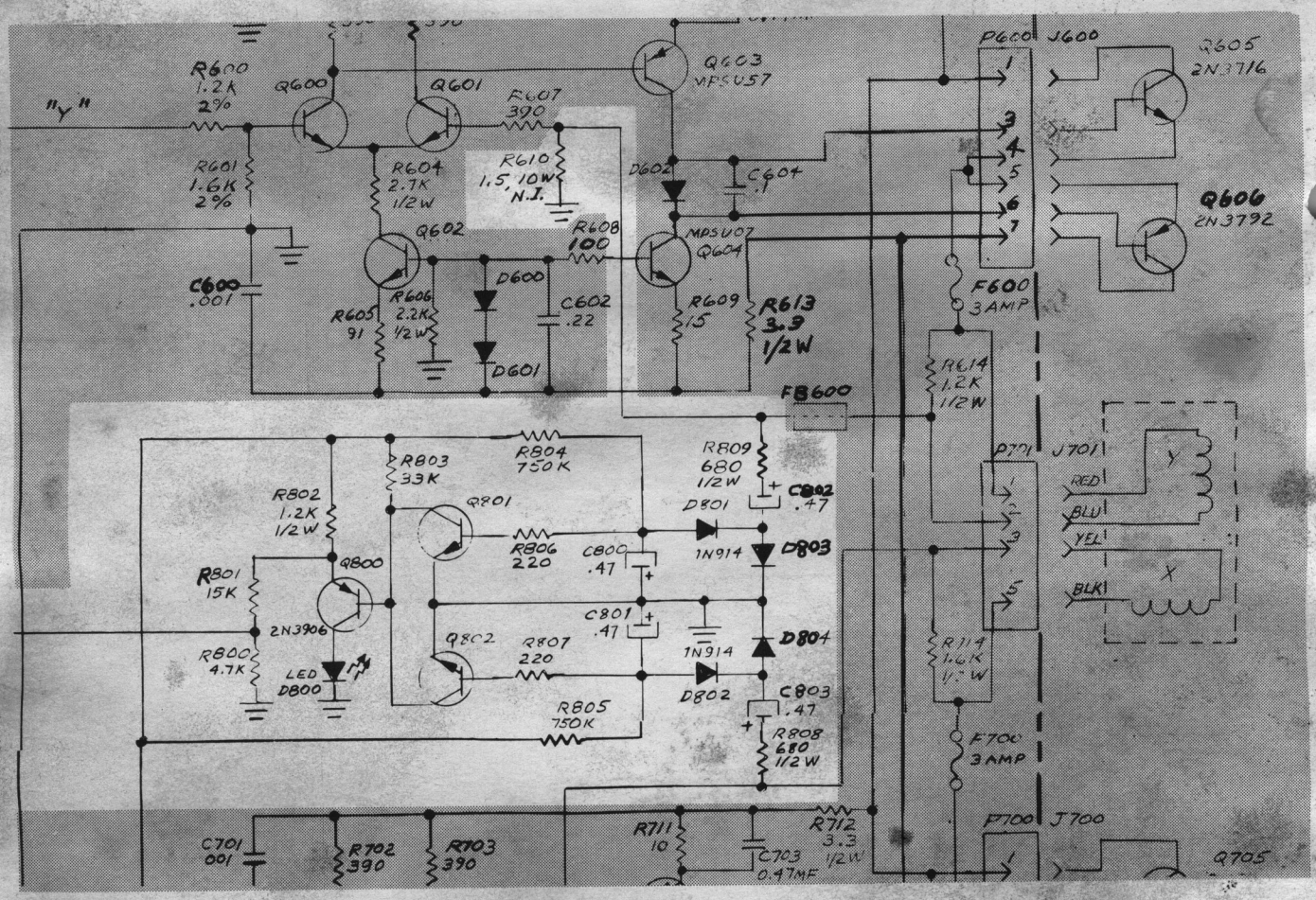


Figure 9 Schematic Diagram of Spot Killer Circuitry

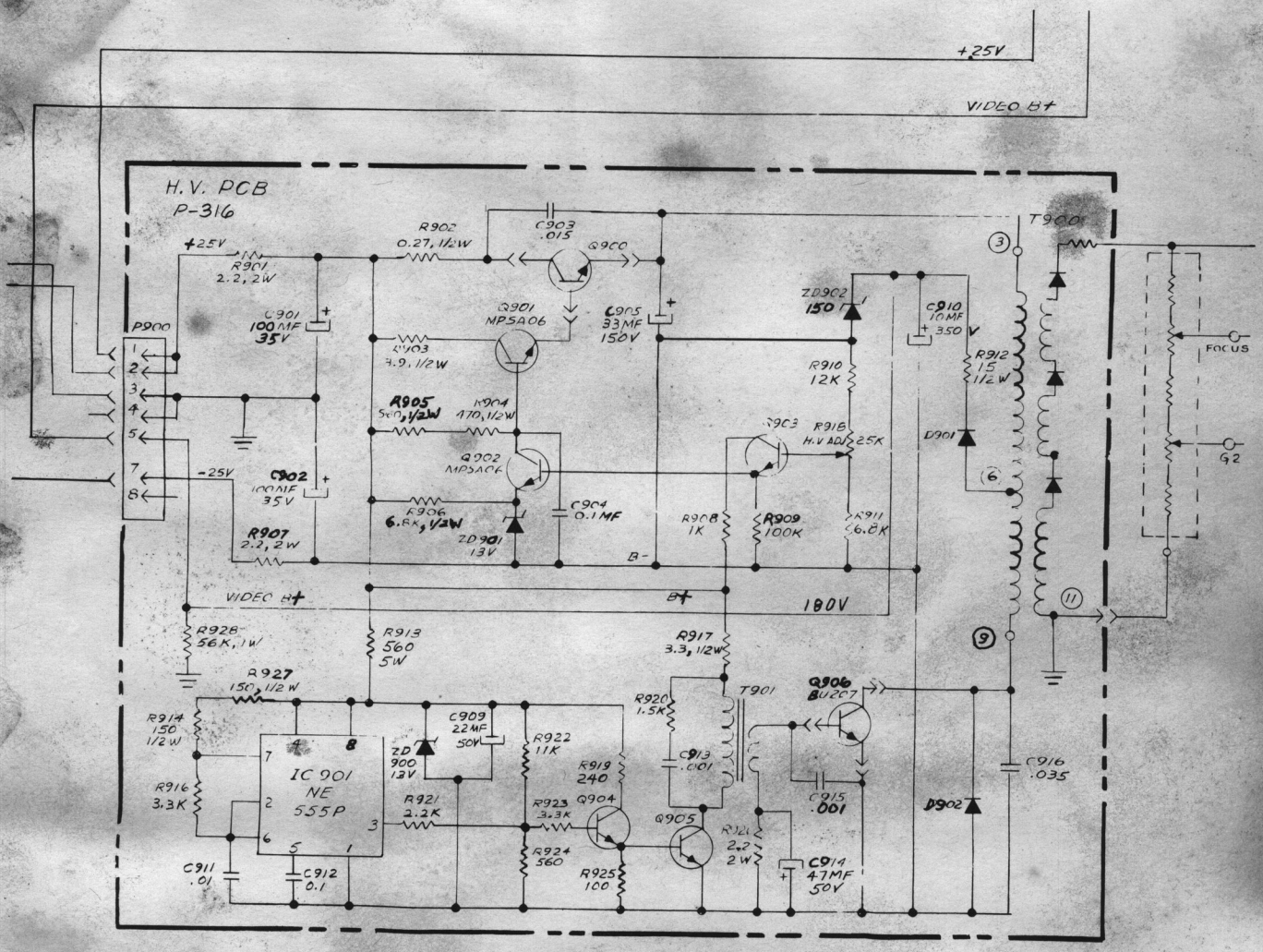


Figure 10 Schematic Diagram of High-Voltage Power Supply

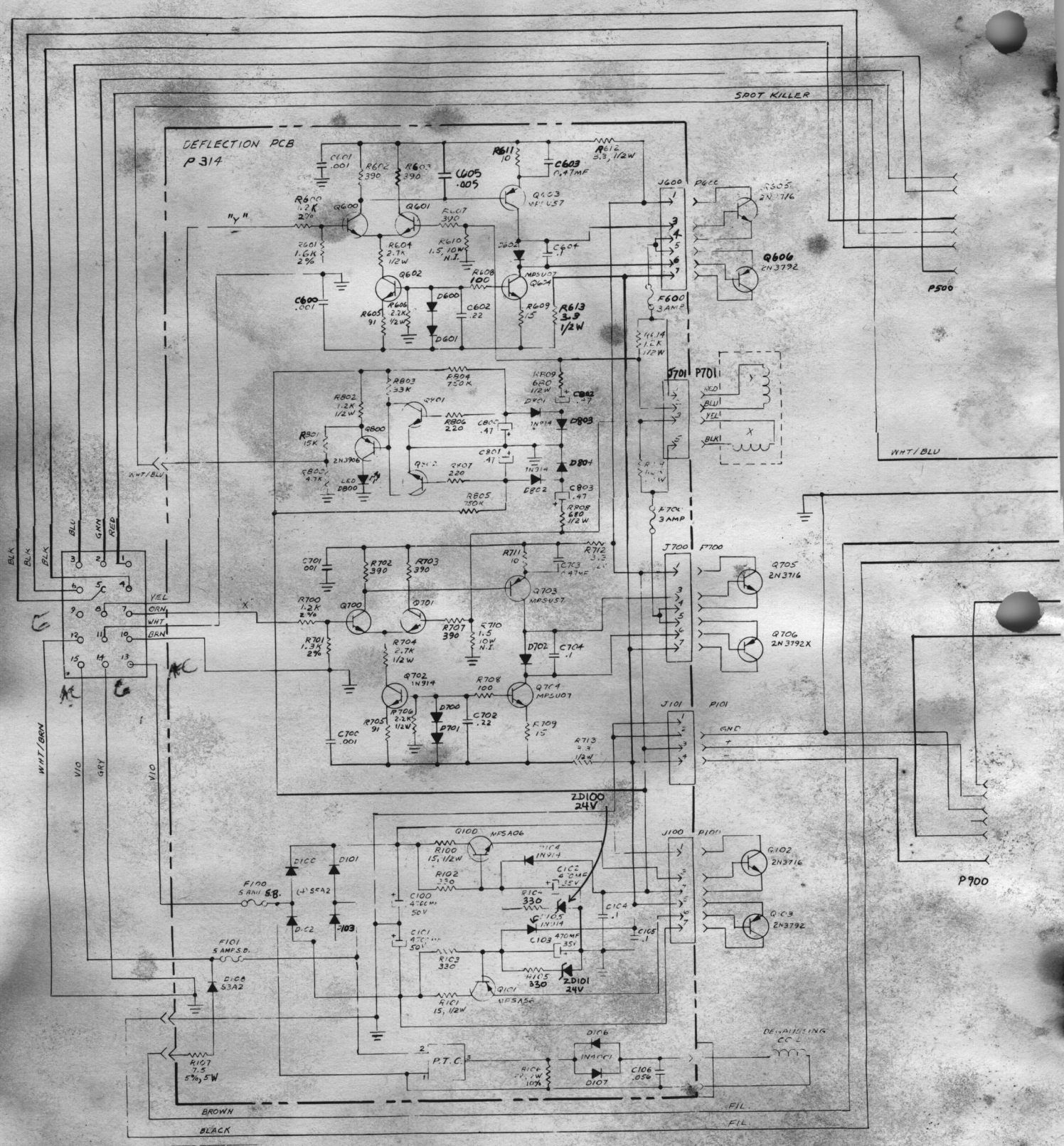
E. High Voltage Power Supply

Integrated circuit IC901 is a timer circuit that produces a 20 KHz output which drives transistors Q904 and Q905. Transistors Q904 and Q905 are current amplifiers that drive the primary of the step-down transformer T901 (current gets stepped up). Transistor Q906 amplifies the current further and from there the 20KHz signal is applied to the primary of the high voltage step-up transformer T900. The output of the secondary windings is applied to the picture tube at the focus and intensity grids and the 19.5 KV anode.

Diode D901 allows capacitor C910 to charge to +180 volts during the discharge of the primary's magnetic field. Transistors Q900, Q901, Q902 and Q903 are error amplifiers that regulate the +180 volt video B+. Pot R918 provides an adjustment to the video B+ and hence the high voltage.

CAUTION

At no time is the high voltage PCB to be serviced while power is applied. An extremely high voltage is present within this circuit. Output of the high voltage power supply is over 19 thousand volts.



GENERAL NOTES:

1. RESISTANCE VALUES IN OHMS 1/4 WATT, 5% UNLESS OTHERWISE NOTED. K = 1,000 M = 1,000,000
2. CAPACITANCE VALUE OF 1 OR LESS IN MICROFARADS. ABOVE 1 IN PICOFARADS UNLESS OTHERWISE NOTED.

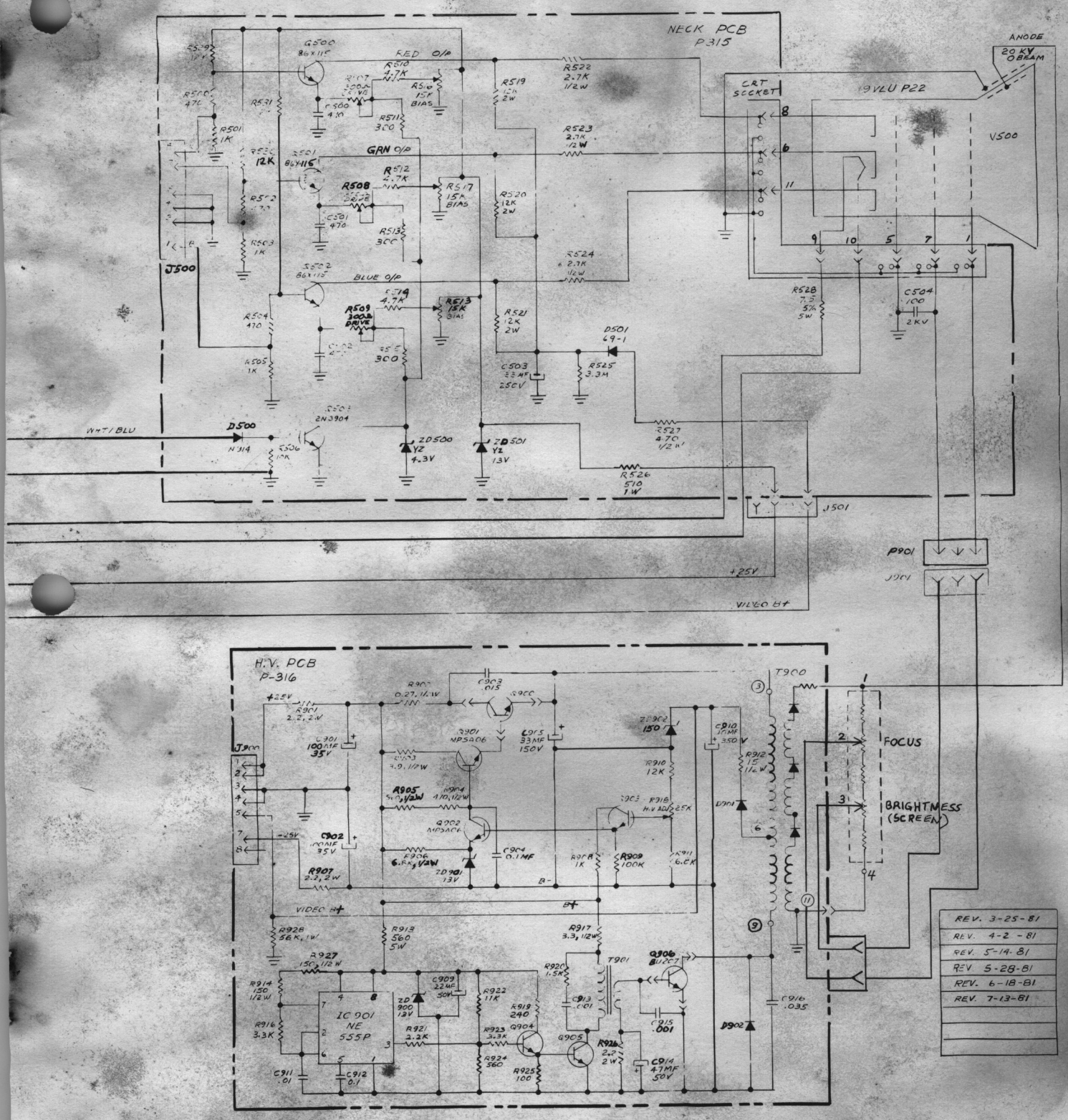


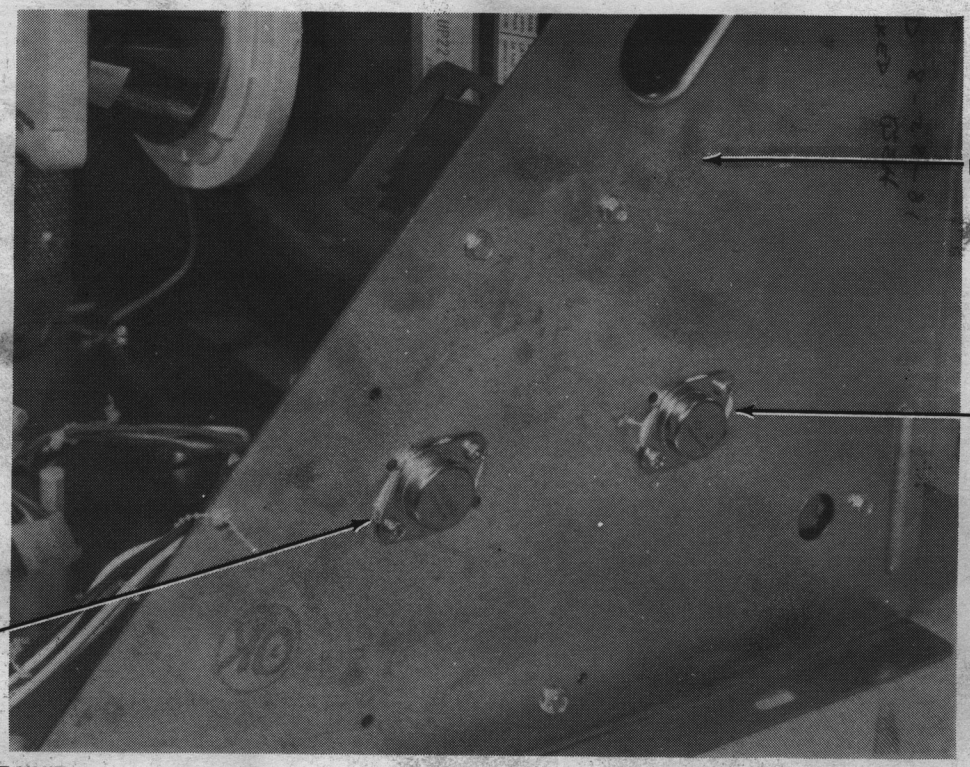
Figure 11 Monitor Schematic Diagram

7 Illustrated Parts List

This chapter provides you with the necessary information for ordering replacement parts for your 19-inch Wells-Gardner color X-Y monitor. Please note that, for simplicity, **common hardware has been deleted** from these parts lists. This includes screws, nuts, washers, bolts, etc.

When ordering parts from your distributor, give the Atari part number, part name, applicable figure number of this manual, and serial number of your monitor. This will help to avoid confusion and mistakes in your order. We hope the results will be less downtime and more profit from your game.

Figure 12 Monitor Assembly
92-053 C



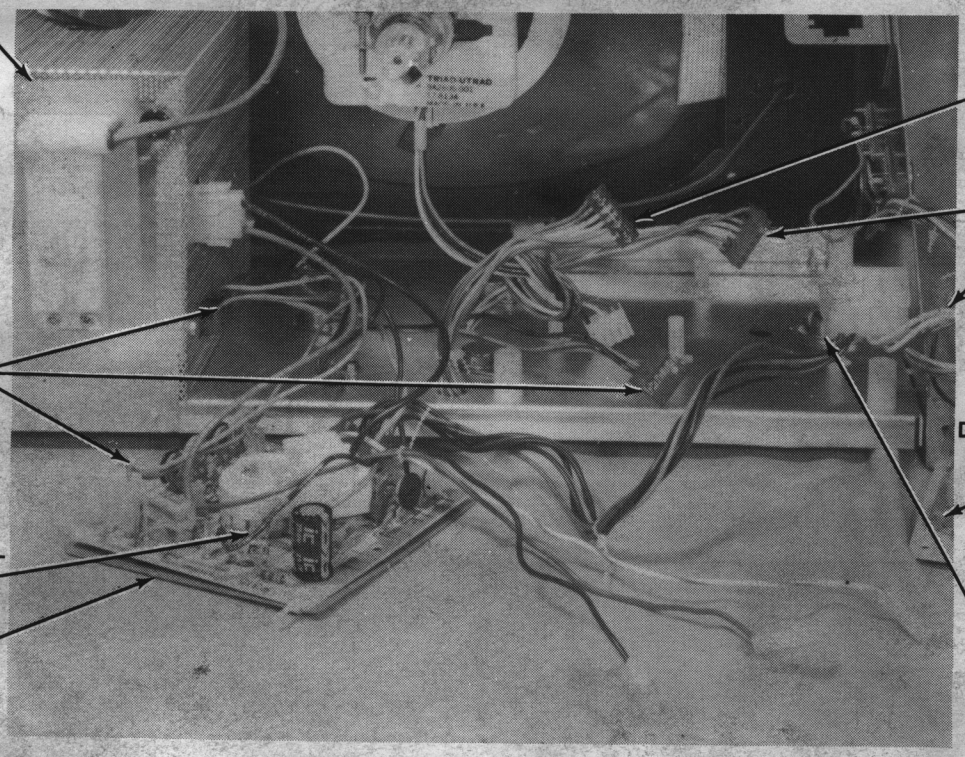
LEFT PANEL ASSY.

2N3716 TRANSISTOR (Q605)

2N3792 TRANSISTOR (Q606)

HIGH-VOLTAGE UNIT ASSY. (BU207 TRANSISTOR IS HIDDEN FROM VIEW ON FRONT OF ASSY.)

(Y SOCKET ASSEMBLIES HIDDEN FROM VIEW)



POWER-SUPPLY CABLE ASSY.

X CABLE ASSY.

Y SOCKET ASSY.

POWER CABLE ASSY.

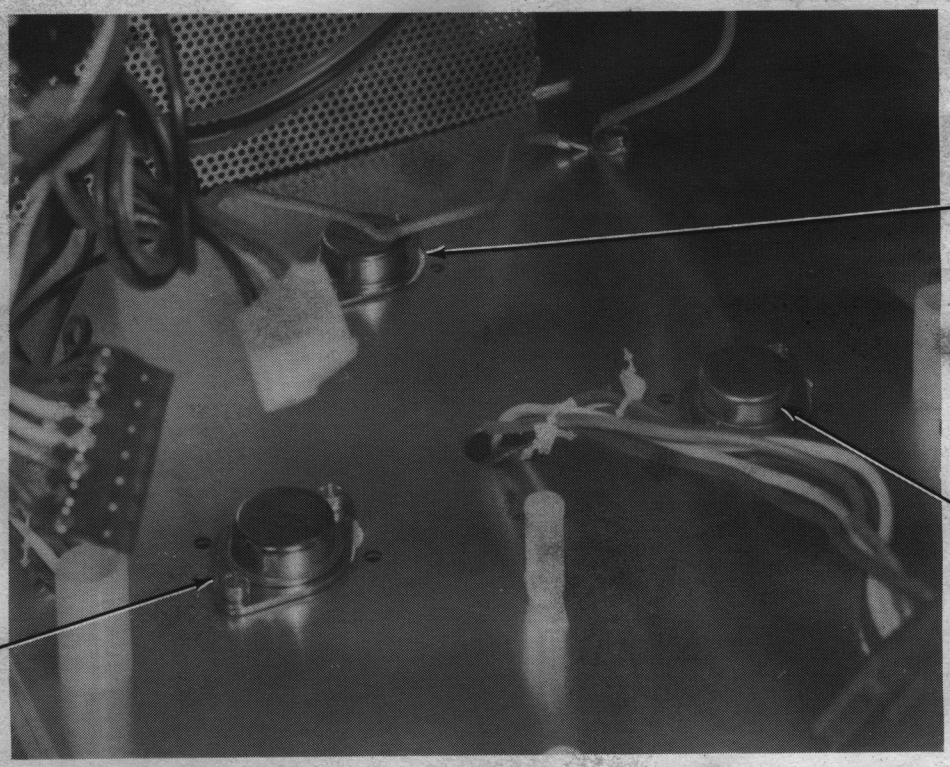
DEFLECTION PCB— *see Figure 13*

NECK PCB ASSY.— *see Figure 14*

BARRIER

2N3792 TRANSISTOR (Q103)

Figure 12 Monitor Assembly
92-053 C



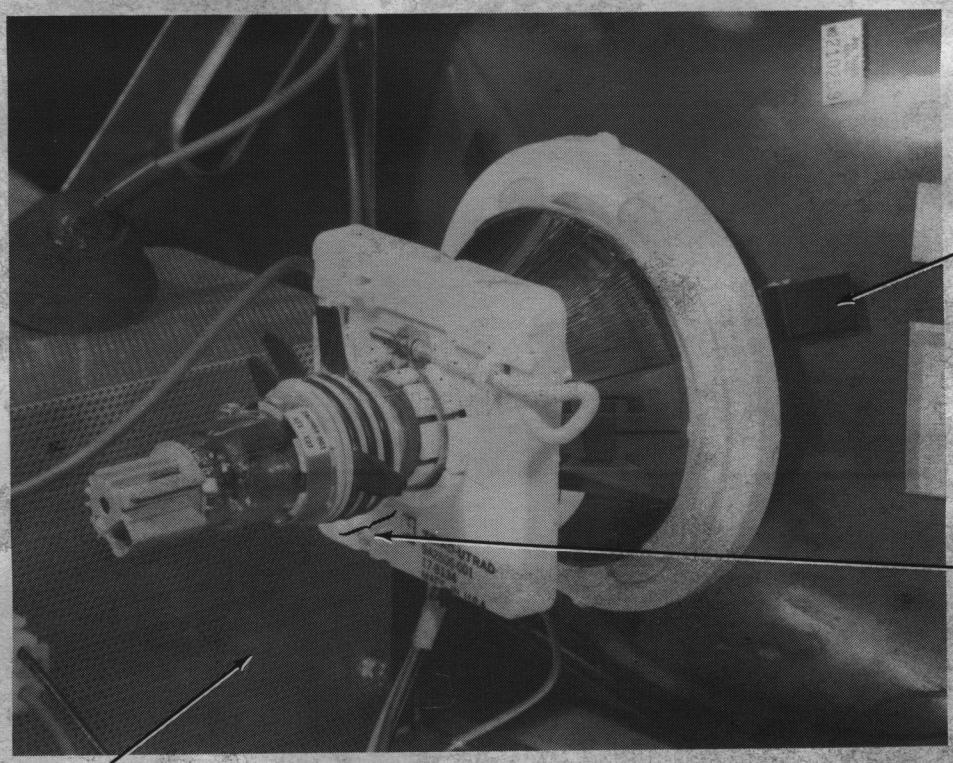


Figure 12 Monitor Assembly
92-053 C

Figure 12 Monitor Assembly, continued
Parts List

Atari Part No.	*Description (Reference Designations in Bold)*
99-130416	Type-2N3716 Transistor **(Q102, 705)**
99-130417	Type-2N3792 Transistor **(Q103, 706)**
99-130468	X Cable Assembly *Assembly consists of: 99-130422—7-Crct. Housing and 99-130481—Key Plug*
99-130469	Power-Supply Cable Assembly *Assembly consists of: 99-130427—7-Circuit Header Connector and 99-130481—Key Plug*
99-130470	Left Panel Assembly *Assembly consists of: 99-130416—Type-2N3716 Transistor* **(Q605)**, *99-130417—Type-2N3792 Transistor* **(Q606)**, *and 99-130483—Y Socket Assy.*
99-130471	Purity Shield/Degaussing Assembly *Assembly consists of: 99-130484—Riveted Purity Shield Assy., 99-130485—Degaussing Coil Assy., 99-130486—AMP Connector, and 99-130488—DAG Spring Assy.*
99-130472	Type-19VLUP22 Picture Tube
99-130473	High-Voltage Unit Assembly *Assembly consists of: 99-130446—Type-BU409 Transistor, 99-130490—High-Voltage PCB Assy. (see Figure 15), 99-130491—Focus/G2 Lead Assy., 99-130492—Ground Lead Assy., and 99-130122—Type-BU207 Transistor.*
99-130474	Deflection PCB Assembly—*see Figure 13*
99-130475	Power Cable Assembly *Assembly consists of: 99-130493—#22 8-Circuit Connector, 99-130494—#22 5-Circuit Connector, 99-130495—AMP Pin Receptacle, and 99-130496—AMP Connector.*
99-130476	Deflection Yoke
99-130477	Deflection-Yoke Wedge
99-130478	Lateral/Purity Assembly
99-130479	Neck PCB Assembly—*see Figure 14*
99-130480	Barrier for Neck PCB
99-130483	Y Socket Assembly *Assembly consists of: 99-130422—#22 7-Circuit Connector Receptacle, 99-130497—Transistor Socket, and 99-130481—Key Plug*
99-130489	Riveted High-Voltage Assembly *(includes sheet-metal housing, bracket, and 2 rivets)*
99-130491	Focus/G2 Lead Assembly
99-130492	Ground Lead Assembly

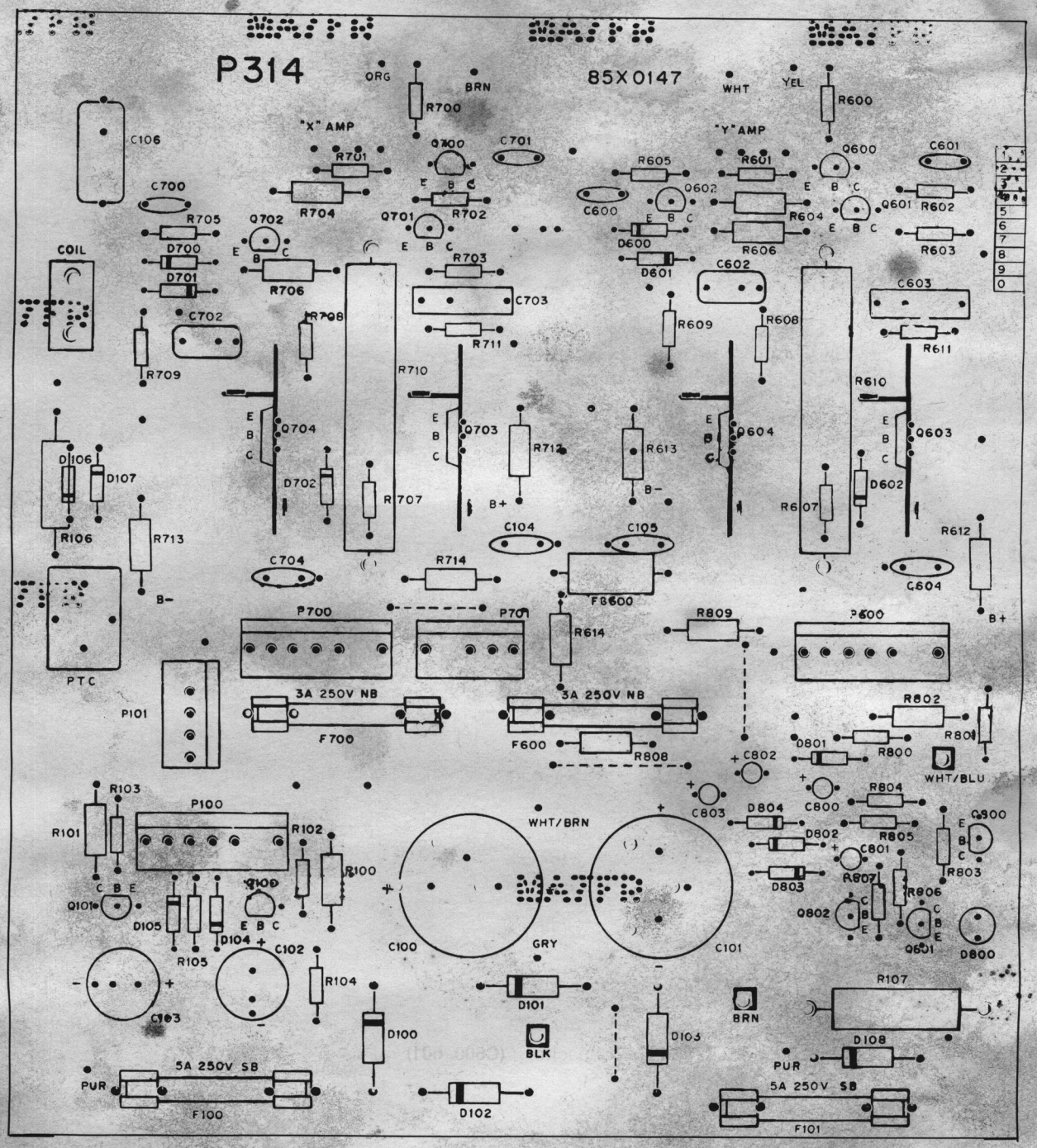


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Figure 13 Deflection PCB Assembly
99-130474 C

Figure 13 Deflection PCB Assembly, continued
Parts List

Atari Part No.	*Description (Reference Designations in Bold)*
99-130076	2.2K Ohm, ±5%, ½W Resistor **(R606, 706)**
99-130128	Type-2N3906 PNP Transistor **(Q800)**
99-130130	Type-MPSA06 NPN Transistor **(Q100)**
99-130134	Type-MPSA56 PNP Transistor **(Q101)**
99-130351	100 Ohm, ±5%, ¼W Resistor **(R608, 708)**
99-130354	330 Ohm, ±5%, ¼W Resistor **(R102, 103)**
99-130366	3.3 Ohm, ±5%, ½W Resistor **(R612, 613)**
99-130369	33K Ohm, ±5%, ¼W Resistor **(R803)**
99-130385	220 Ohm, ±5%, ¼W Resistor **(R806, 807)**
99-130389	91 Ohm, ±5%, ¼W Resistor **(R605, 705)**
99-130400	.1 uf Radial-Lead Ceramic-Disc 50V Capacitor **(C604, 704)**
99-130401	.47 uf Aluminum Electrolytic Fixed Axial-Lead 35V Capacitor **(C800, 801)**
99-130405	.22 uf 50V Capacitor **(C602, 702)**
99-130407	Type-S3A2 Diode **(D108)**
99-130408	Type-1N914B Diode **(D104, 105, 600, 601, 700, 701, 801-804)**
99-130409	Light-Emitting Diode **(D800)**
99-130411	Type-1N4001 Diode **(D106, 107, 602, 702)**
99-130412	Type-TPS98 NPN Transistor **(Q600-602)**
99-130414	PNP Transistor Assembly **(Q603, 703)** *Assembly consists of: 99-130564—PNP Transistor, and 99-130563—Heat Sink*
99-130415	NPN Transistor Assembly **(Q604, 704)** *Assembly consists of: 99-130562—NPN Transistor, and 99-130563—Heat Sink*
99-130418	5-Amp. Slow-Blow Fuse **(F100, F101)**
99-130427	7-Circuit Header Connector **(P600, 700)**
99-130429	5-Circuit Header Connector **(P101, 701)**
99-130527	7.5 Ohm, ±5%, 5W Resistor **(R107)**
99-130547	1.5 Ohm, ±5%, 10W Resistor **(R610, 710)**
99-130548	Type-S5A2 Diode **(D100-103)**
99-130549	22 Ohm, ±10%, 2W Resistor **(R106)**
99-130550	Positive-Temperature-Coefficient Thermistor
99-130551	Fuse Clip
99-130552	3-Amp. Normal-Blow Fuse **(F600, F700)**
99-130553	.001 uf, ±20%, Type-Z5F Capacitor **(C600, 601)**
99-130554	.47 uf 100V Capacitor **(C603, 703)**
99-130555	4700 uf Aluminum Electrolytic Fixed Axial-Lead 50V Capacitor **(C100, 101)**
99-130556	470 uf Aluminum Electrolytic Fixed Axial-Lead 35V Capacitor **(C102, 103)**
99-130557	.056 uf, ±10%, 400V Capacitor **(C106)**
99-130558	Ferrite Bead **(FB600)**
99-130559	#20 Guage Bare Wire
99-130560	Purple Lead Assembly
99-130561	15-Circuit Connector Assembly *Assembly consists of: 99-130565—15-Circuit Connector, and 99-130493—#22 Guage 8-Circuit Housing*
99-130577	15 Ohm, ±5%, ½W Resistor **(R100, 101)**
99-130587	1.2K Ohm, ±2%, ¼W Resistor **(R600, 700)**

[Continued on next page]

Figure 13 Deflection PCB Assembly, continued
Parts List

Atari Part No.	*Description (Reference Designations in Bold)*
99-130588	1.6K Ohm, ±2%, ¼W Resistor **(R601)**
99-130589	1.3K Ohm, ±2%, ¼W Resistor **(R701)**
99-130590	390 Ohm, ±5%, ¼W Resistor **(R602, 603)**
99-130591	10 Ohm, ±5%, ¼W Resistor **(R611, 711)**
99-130592	15 Ohm, ±5%, ¼W Resistor **(R609, 709)**
99-130593	15K Ohm, ±5%, ¼W Resistor **(R801)**
99-130594	750K Ohm, ±5%, ¼W Resistor **(R804, 805)**
99-130595	2.7K Ohm, ±5%, ½W Resistor **(R604, 704)**
99-130596	1.2K Ohm, ±5%, ½W Resistor **(R614, 802)**
99-130597	1.6K Ohm, ±5%, ½W Resistor **(R714)**
99-130598	680 Ohm, ±5%, ½W Resistor **(R808, 809)**
99-130599	24V, ±5%, 1W Zener Diode **(ZD100, 101)**

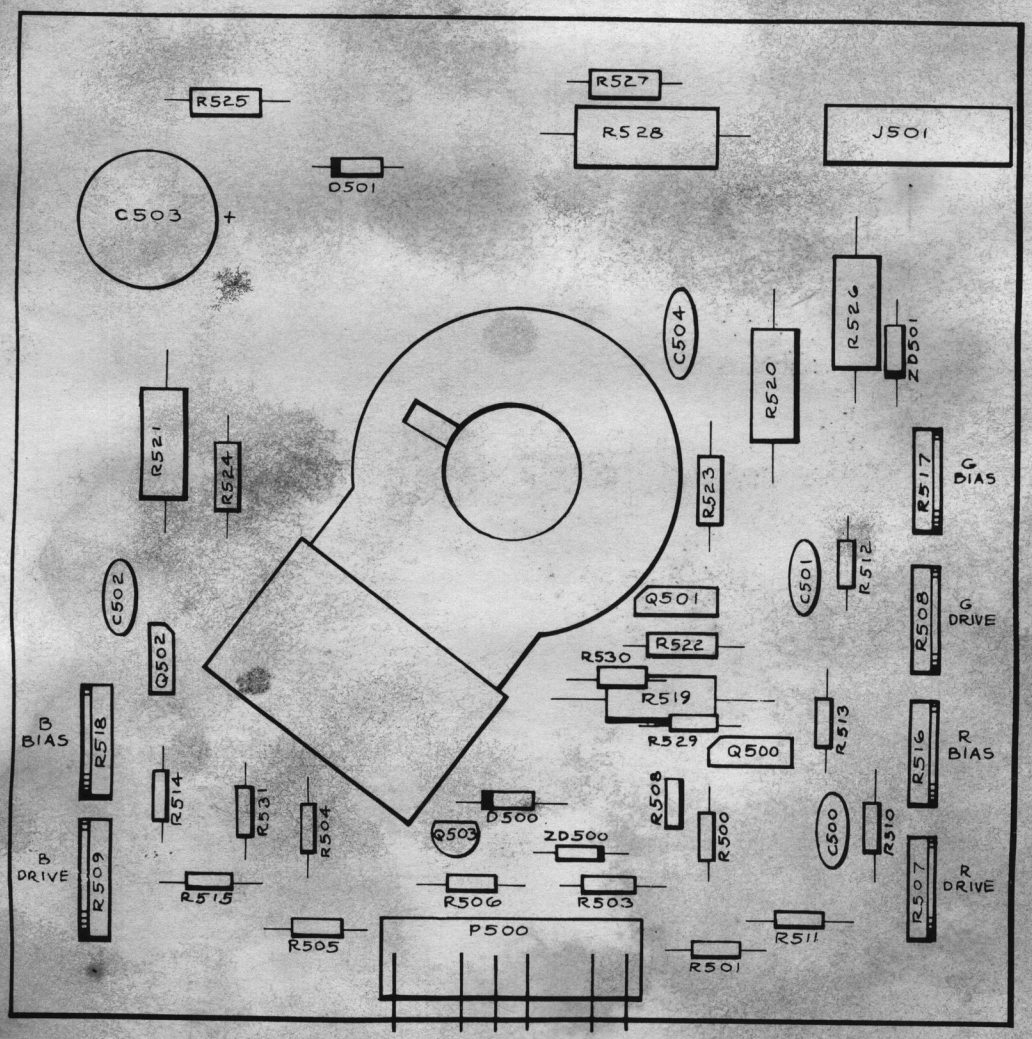

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Figure 14 Neck PCB Assembly
99-130479 C

Figure 14 Neck PCB Assembly, continued
Parts List

Atari Part No.	*Description (Reference Designations in Bold)*
99-130034	470 pf, ±10%, Type-Z5F Radial-Lead Ceramic-Disc Capacitor **(C500-502)**
99-130111	470 Ohm, ±5%, ½W Resistor **(R527)**
99-130129	Type-D40P3 NPN Transistor **(Q500-502)**
99-130380	470 Ohm, ±5%, ¼W Resistor **(R500, 502, 504)**
99-130392	1K Ohm, ±5%, ¼W Resistor **(R501, 503, 505)**
99-130408	Type-1N914B Diode **(D500)**
99-130410	250V Diode **(D501)**
99-130413	Type-2N3904 NPN Transistor **(Q503)**
99-130525	12K Ohm, ±5%, 2W Resistor **(R519-521)**
99-130526	510 Ohm, ±5%, 1W Resistor **(R526)**
99-130527	7.5 Ohm, ±5%, 5W Resistor **(R528)**
99-130528	100 pf, ±10%, Radial-Lead Ceramic-Disc 2KV Capacitor **(C504)**
99-130529	33 uf Aluminum Electrolytic Fixed Axial-Lead 250V Capacitor **(C503)**
99-130530	300 Ohm Clear Control **(R507-509)**
99-130531	15K Ohm Black Control **(R516-518)**
99-130532	Picture-Tube Socket
99-130533	8-Circuit Right-Angle Header Connector
99-130534	Black Wire Assembly *Assembly consists of: 99-130495—Pin Receptacle and 99-130540—1-Circuit Housing*
99-130535	Brown Wire Assembly *Assembly consists of: 99-130495—Pin Receptacle and 99-130540—1-Circuit Housing*
99-130536	White/Blue Wire Assembly *Assembly consists of: 99-130495—Pin Receptable and 99-130540—1-Circuit Housing*
99-130537	Ground Wire Assembly
99-130538	Focus and Red Wire Assembly *Assembly consists of: 99-130541—Focus Wire Assy., 99-130542—Red Wire Assy., and 99-130543—3-Circuit Plug*
99-130539	SG Lead Assembly
99-130575	13V, ±5%, 1W Zener Diode **(ZD501)**
99-130578	12K Ohm, ±5%, ¼W Resistor **(R529-531)**
99-130581	10K Ohm, ±5%, ¼W Resistor **(R506)**
99-130582	300 Ohm, ±5%, ¼W Resistor **(R511, 513, 515)**
99-130583	2.7K Ohm, ±10%, ½W Resistor **(R522-524)**
99-130584	3.3 MegOhm, ±10%, ½W Resistor **(R525)**
99-130585	4.3V, ±5%, ½W Zener Diode **(ZD500)**
99-130586	4.7K Ohm, ±5%, ¼W Resistor **(R510, 512, 514)**

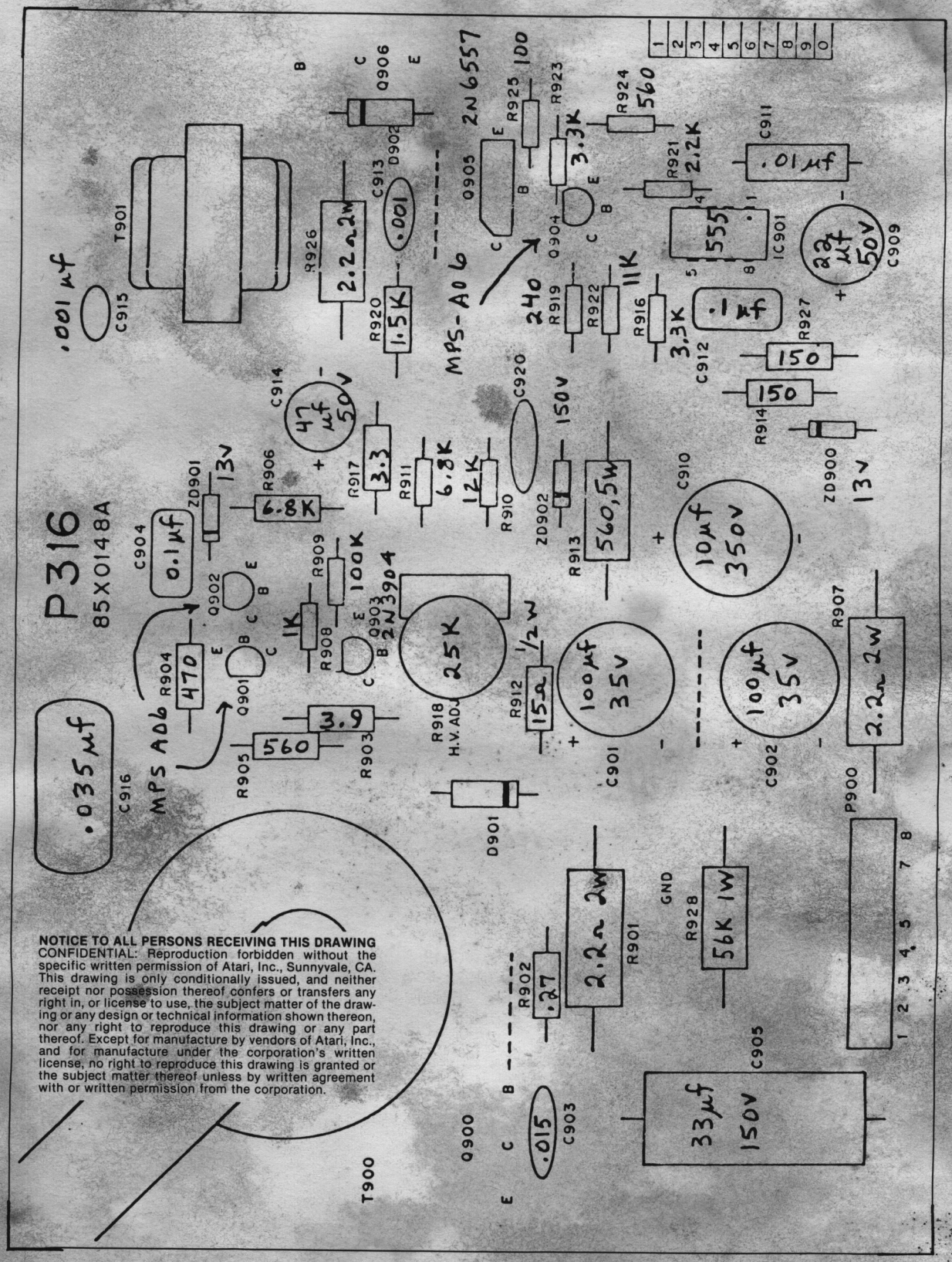

Figure 15 High-Voltage PCB Assembly
99-130490 C

Figure 15 High-Voltage PCB Assembly, continued
Parts List

Atari Part No.	*Description (Reference Designations in Bold)*
99-130007	33 uf Aluminum Electrolytic Fixed Axial-Lead 150V Capacitor **(C905)**
99-130008	47 uf Aluminum Electrolytic Fixed Axial-Lead 50V Capacitor **(C914)**
99-130021	1000 pf, ±10%, Radial-Lead Ceramic-Disc 500V Capacitor **(C915)**
99-130028	.1 uf, ±20%, Radial-Lead Epoxy-Dipped 100V Mylar Capacitor **(C904)**
99-130049	Horizontal Driver Transformer **(T901)**
99-130087	1.5K Ohm, ±5%, ½W Resistor **(R920)**
99-130089	2.2 Ohm, ±5%, 2W Resistor **(R901, 907, 926)**
99-130094	150 Ohm, ±5%, ½W Resistor **(R914, 927)**
99-130111	470 Ohm, ±5%, ½W Resistor **(R904)**
99-130115	3.9 Ohm, ±5%, ½W Resistor **(R903)**
99-130130	Type-MPSA06 NPN Transistor **(Q901, 902, 904)**
99-130132	Type-2N6557 Horizontal Driver Transistor **(Q905)**

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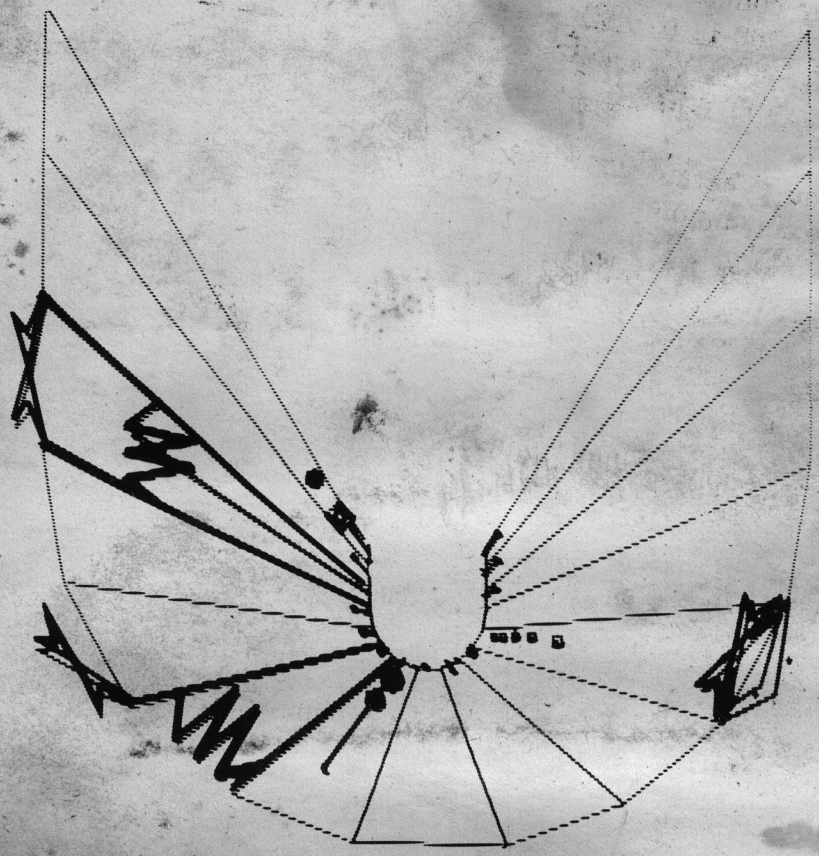

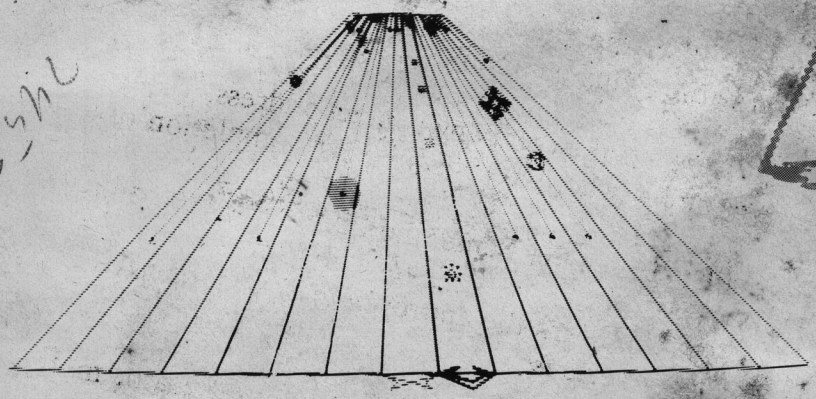

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